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Consumer search and income inequality☆

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ABSTRACT

Competition and consumer search costs can lead to price dispersion in an oligopoly. IO research has long identified the existence of search costs and estimated their distribution and is now beginning to study which consumers sit where in the distribution. This paper argues for a view of consumer protection and competition policy that considers distributional outcomes along with efficiency. We discuss the evidence on how consumer search varies over the income distribution and provide a literature review that summarizes research on (i) the search-income gradient; (ii) mechanisms for the gradient; and (iii) how search-based price discrimination can give rise to regressive price dispersion. Through our review, we collect evidence from a wide range of industries that shows that low-income consumers tend not to search. We then draw on research from IO, marketing, finance, urban, and behavioral economics for explanations as to why this pattern persists. Finally, we conclude that IO researchers have much to offer in identifying and quantifying the distributional impacts of market power, thereby contributing to current academic and policy debates on efficiency-equity trade-offs in policy design.

1. Introduction

For more than a generation, governments worldwide have deregulated industries to enhance economic efficiency and reduce prices paid by consumers. But consumer gains from competition depend on how attentive consumers are to prices. There is an extensive empirical literature documenting that many consumers fail to shop enough to obtain the best details, from mortgages (Woodward and Hall, 2012; Allen et al., 2014; Alexandrov and Koulayev, 2017) to credit cards (Stango and Zinman, 2016), savings accounts (Adams et al., 2019), gasoline (Lach and Moraga-González, 2017), and pharmaceuticals (Sorensen, 2000). This work follows from an established theoretical literature that shows how search costs can explain equilibrium price dispersion (Burdett and Judd, 1983; Salop and Stiglitz, 1977; Stahl, 1989; Stigler, 1961). Empirical research on search costs has long focused on recovering and describing the distribution of search costs across consumers (e.g., Hortacsu and Syverson, 2004; Hong and Shum, 2006; Moraga-González and Wildenbeest, 2008; Kaplan and Menzio, 2015), but little is known as to who sits where in that distribution.

Who engages most in search? And, perhaps more critically from a policy perspective, who fails at search? For policymakers considering deregulation and decentralized price-setting, a central question is whether or not lower income consumers actively and effectively search for prices and, as a result, whether they will end up paying higher or lower prices.

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Retail electricity provides an important case in point. Energy market deregulation has led to substantial price dispersion in retail electricity prices in many countries (Giulietti et al., 2014; Hortaçsu et al., 2017; Byrne, Martin, Nah). Proponents of deregulation that would decentralize price-setting by retailers *a priori* anticipated price dispersion, but presumed it would be progressive (Thwaites et al., 2017): lower income households, with a lower opportunity cost of time and a higher valuation of search-related electricity cost savings, would actively engage in retailer search and switching and realize lower prices. With this form of consumer segmentation, cost savings achieved from deregulation would go disproportionately to lower-income households. However, after 20 years of deregulation, many governments report that low-income consumers exhibit the lowest propensity to search, have extreme retailer inertia, and pay some of the highest electricity prices (Competition and Markets Authority, 2016; Brattle Group, 2018; Australian Competition and Consumer Commission, 2018).

The experience of lower-income consumers being less likely to search for and obtain the best deals is likely to apply beyond energy markets. Other important industries that feature significant consumer search costs include healthcare, banking, telecommunications, retail, or air travel. There is, however, limited evidence to date into the relationship between a consumer's income and their level of engagement in markets. Search and consideration sets are rarely directly observed, measures of search cost inferred from prices paid are often confounded by unobservables, and individual-level data on consumer search tends to be proprietary or only crudely matched to income, if at all. Researchers in IO are, however, beginning to gain access to administrative, scanner, and online search platform data that allows us to study search frictions over the income distribution and resulting distributional impacts of market power.

In this paper, we provide a literature review of research on the relationship between consumer search and income. Some of the papers that we describe tackle this relationship head on. Most, however, have different goals and address the search-income gradient only indirectly. We believe that the observed relationship between income and search behavior is a first-order question of interest for both researchers and policymakers, and that emerging data and econometric methods in IO present a real opportunity to better understand search-related linkages between market power and inequality.

The paper proceeds in four parts. In Section 2, we collect research examining how search varies over the income distribution. We add to this evidence base using new, individual-level data on search and income from retail electricity. Our findings, along with those from prior studies from different industries using different empirical methods, reveal an inverse-U shape relationship between consumers' willingness to search and their income: both the very poor and the very rich tend not to search.

Section 3 develops an extensive analysis of potential mechanisms for the inverse-U relationship, and for understanding why low-income households are less-engaged in search behavior. In identifying potential mechanisms, we draw upon and organize findings from IO, financial literacy, urban, and behavioral economics. Section 4 then discusses supply-side responses to the search-income gradient and the potential for search-based price discrimination and regressive price dispersion.

We summarize and conclude in Section 5. Here, we connect the research agenda outlined in the paper to long-standing research programs in economics on inequality in areas such as political economy or trade, but also burgeoning research programs in macroeconomics and market design. IO economists can inform these academic and policy debates by establishing how search frictions in the many large concentrated industries that dominate the day-to-day lives of many households contribute to income inequality. Such analyses would see IO economists, like those in other fields, inform efficiency–equity trade-offs in policy design.

2. How search behavior varies with income

Relating search to income is not a particularly easy task. Income data are often not available or only crudely measured: they may, for example, be only available at the census-block instead of the individual level. Alternately, they may be only available in broad categories, like above/below median or in a few discrete brackets. Finally, translating observed search to willingness to search is complicated by self-knowledge of own search costs and the fact that income is often correlated with consumption intensity or preferences for unobserved product quality, which affects the returns to search. Here, we summarize papers that study the search-income gradient based on stated search, online search, inferred search based on trip frequency, and inferred search based on prices paid, all which attempt to tackle these empirical challenges in unique ways.

2.1. Stated search behavior

The earliest papers that we can find on heterogeneous search involve specially-conducted surveys of 'housewives' and their reported shopping strategies. For example, Goldman (1976) finds that lower-income respondents were aware of fewer furniture stores and reported having engaged in less pre-purchase shopping at fewer stores. Andreasen and Ratchford (1976) finds an inverted-U-shape between the reported number of price quotes obtained for a range of products from plumbers to major household appliances. The authors interpret the results in terms of the highest income groups having a high opportunity cost of time and lowest income groups lacking the mobility, skill, or discretionary time needed to engage in search.

More contemporary surveys that tie consumer income and stated sources of inertia include Kiser (2002) who uses self-reported data on consumer switching behavior and income among bank deposit account holders. She also finds an inverse

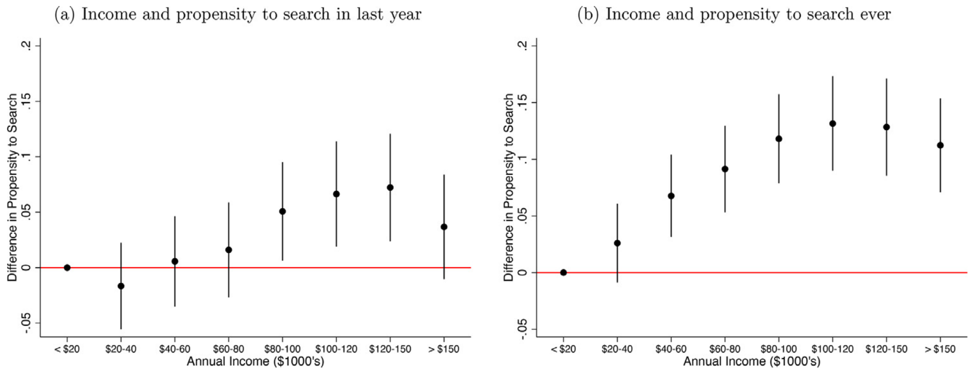

Fig. 1. Income and the propensity to search for electricity contracts.

U-shaped relationship between income and stated switching costs. Specifically, she finds that low income (households earning less than $20,000) and high income (more than $100,000 per year) are most likely to report that it is too inconvenient to switch banks.

Some additional evidence from retail electricity

We add to evidence on the search-income gradient using individual-level stated search and income data from competitive retail electricity markets in Australia. It is derived from survey data from Energy Consumers Australia (ECA) which since December 2016 has surveyed energy consumers across the country every six months, with 2000 households in each survey wave.[1] In each wave, individuals are asked if they have searched among electricity retailers for a new contract both in the past year and ever, irrespective if they ended up switching retailers or not. In addition, the surveys ask individuals to state which of eight income groups they belong to, ranging from less than $20,000 per year to more than $150,000.

With these data, we directly examine the relationship between stated search and income. In particular, we estimate a linear probability model (LPM) where the dependent variable is a dummy equaling one if a household states "yes" to having searched among electricity retailers in the past year, and zero otherwise. The model includes dummy variables for each of the income categories in the survey, and location by survey wave fixed effects.

Panel (a) of Figure 1 plots estimates and their 95% heteroskedasticity-robust confidence intervals for the coefficients on the income categories in the LPM. As documented in earlier survey results, we find an inverse-U relationship as households earning more than $150,000 per year are not statistically different from households earning less than $20,000 per year in terms of their propensity to search. Compared to an average annual search propensity of 0.34 (e.g., 34% of households searched among retailers in the past year), the statistically significant 0.05 to 0.075 estimated increases in search propensity for households in the $80,000 to $120,00 income brackets are non-negligible.

Panel (b) of Figure 1 is analogous to panel (a), except we examine survey responses to having *ever* searched among electricity retailers. As in panel (a), we visually see an inverse-U relationship between searching ever and income, however searching persists at a significantly higher rate for households earning more than $150,000 compared to those earning less than $20,000 per year. The differences in search intensity between the lowest-income households and those earning more than $80,000 per year is again economically significant. The mean propensity to having ever searched is 0.47, which grows by a statistically significant 0.10 to 0.15 amount among households earning more than $80,000 per year.

2.2. Tracking online search behavior

The increasing use of online platforms for search has both dramatically reduced search costs and improved researchers' ability to directly observe and study search behavior, which complements stated search studies. De Los Santos (2018) examines individual-level internet browsing data from ComScore to measure how search durations for consumers shopping for books vary with household characteristics. He finds an inverse-U relationship between a household's income level and the time spent searching online. In particular, households earning less than $15,000 per year and those earning more than $100,000 per year spend between 5 to 20 percent less time searching than households in intermediate-income groups.

Nah (2019) uses individual-level data on search requests from an online retail gasoline price comparison platform to examine the relationship between income and search intensity. She observes much less search intensity across stations located in lower-incomedecile neighborhoods. She also finds that users searching within lower-income neighborhoods are less likely to search at the right time: in a market with Edgeworth price cycles with regular large monthly price jumps, households in low-income neighborhoods are two times less likely to search compared to higher income groups in the two windows when retailers (imperfectly) coordinate on monthly price jumps and the gains to search are highest.

[1] See https://energyconsumersaustralia.com.au/projects/consumer-sentiment-survey.

2.3. Inferring search intensity from shopping trips

There is also research that infers search effort from shopping trip frequency, a method that accounts for both cross-sectional search across stores as well as temporal search for sale prices within a store (Varian, 1980). Aguiar and Hurst (2007) is the prime example: they use AC-Nielsen's Homescan Panel to count the number of distinct grocery shopping trips a family takes in a given month. They document that lower-income consumers (earning less than $30,000 per year) take 16% more shopping trips than high-income searchers (earning more than $70,000 per year), and pay 2.1% less for similar products.

However, the link between shopping trip frequency and search is potentially confounded by liquidity constraints, breadth of product availability within local stores, time available for each trip, and whether the goods need to be carried home by hand or via public transit, which may all vary with income. For example, Orhun and Palazzolo (2019) find low-income households who receive lumpy end-of-month welfare payments are limited in their ability to shop intertemporally for bulk purchases of storable goods (e.g., toilet paper), which raises the average prices they pay relative to higher-income households. This is a clear example of one of many empirical challenges in using shopping trip frequency to infer differential search behavior over the income distribution.

2.4. Inferring search frictions from prices paid

Complementing the above evidence on consumer search and income are recent studies that infer differential search behavior from differential prices paid by consumers. For example, Hortaçsu et al. (2017) examine consumer inertia in Texas's residential electricity market using data on individual-level retailer switching and retailers' posted prices to estimate a structural model of consumer inertia. They find that search frictions and incumbent brand advantages that create switching costs are significantly higher among households who live in poorer areas.

Similarly, Nishida and Remer (2018) find that consumers in lower-income markets exhibit higher average imputed search costs. Using station-level posted price data, they recover search cost distributions that rationalize the station-level price dispersion observed across local gasoline markets across the United States, as per Hong and Shum (2006). They then regress the mean of each distribution on the mean income level in each market to infer differential search outcomes by income. Their model specification does not allow for potential non-monotonicities, like an inverse U-shape, in the search-income relationship.

There are two recent and relevant papers studying the mortgage market, both using individual-level administrative data. The first, Allen et al. (2019), does not focus on the income-search relationship per se, but presents a structural model of individually-negotiated mortgages between consumers and banks that allows unobserved consumer search costs to vary unidirectionally with household income. They find that mean search costs for mortgages increase with income in the Canadian mortgage market. Andersen et al. (2020) show the opposite. Using Danish administrative data on mortgages, they show that lower income households refinance less often and miss out on greater savings both as a percentage of mortgage principal and, even more so, as a fraction of income. They use potential refinancing gains and observed behavior to back out imputed psychological costs of refinancing, and show that these costs are highest for lower income consumers.

Finally, Eizenberg et al., 2020 examine retail food price differentials across different neighborhoods in Jerusalem using CPI price data on individual products and neighborhood-level credit card expenditure data. They also find that lower-income households on the city's periphery tend to pay the highest prices and are the least likely to shop outside of their own neighborhoods. As we further discuss in Section 3 below, underpinning these findings are differential spatial frictions that affect low and high-income consumers' ability to search for and find lower prices across within a market.

Quantity and quality confounds. Before discussing mechanisms, we emphasize a key challenge for research going forward in inferring the income-search gradient from prices paid: product mix and, in some markets, quality are likely to simultaneously vary with individual income. Sorensen (2000) partials out variation in prices associated with brands or product characteristics to focus on the part of price dispersion arising from search frictions. And recent research in urban economics from Handbury (2019) shows how differences in product bundles and unobserved variation in product quality can erroneously be attributed to income levels across local urban areas. In the studies we cited above, Hortaçsu et al. (2017) and Nishida and Remer (2018) both involve homogeneous product markets (electricity and gasoline) that are least likely to suffer from product confounds and both point to the lowest income consumers facing the highest search costs. As richer individual-level information on prices paid (e.g., administrative, scanner, or digital platform data) becomes available to study the search-income gradient, accounting for product confounds will be critical in isolating price dispersion that is attributable to differences in search frictions across income groups.

3. Why low-income consumers may fail to fully engage in the market

The prevailing intuition between income and search has been that lower-income households have lower opportunity costs of time in terms of market wages and are hence willing to search more to find better deals. This intuition has motivated, for example, energy market deregulation as discussed in the Introduction (e.g., Thwaites et al., 2017), and has been pointed to by empirical academic papers that find more search or lower prices paid by lower income households (e.g., Aguiar and Hurst, 2007).

However, wages may not be a great proxy for time costs for lower income households who are also time poor, such as single-parent households or workers juggling multiple jobs. Indeed, there are several factors that can explain low levels of search among the poor documented in Section 2: search may be more challenging or costly for lower-income consumers if there's a longer physical distance to travel, if they have less access to online search platforms, or if they are less able to search or negotiate effectively. In this section, we collect and summarize literature from different areas in economics that speak to these four potential mechanisms for why low-income consumers may fail to search.[2]

3.1. Physical travel

The physical costs of search may vary across income groups if the economic geography of urban areas provides lower-income households with fewer local retailers and price options. Evidence of such 'retail deserts' in poorer areas has been documented with groceries (Allain et al., 2017; Chung and Myers, 1999; Eizenberg et al., 2020; MacDonald and Nelson, 1991; Talukdar, 2008) and movie theatres (Dubé et al., 2017).

Even if distances to travel are equal, the per kilometer cost may vary with income, if, for example, travel is particularly difficult for the disabled or elderly, who are often of lower income. Likewise, lower income households may rely more heavily on public transit for transportation (Blumenberg and Manville, 2004; Giuliano, 2005), which again would make search more costly in terms of time and effort compared to higher income households.

3.2. Access to online platforms

Differential digital costs of search could also explain differences in search by income groups. Poorer households are significantly less likely to have broadband internet at home and high-tech devices like smartphones (Anderson, 2019).[3] Likewise, lower-income subgroups such as the elderly may be less adept or comfortable using online search platforms, which would also imply a higher effective cost of search.[4] In short, the "digital divide" between high and low income groups (Goldfarb and Prince, 2008) can also underlie income-based differences in search behavior.

3.3. Searching effectively

There is a growing literature documenting behavioral biases that prevent consumers from fully engaging in markets and properly determining the best deals available to them. Zhou and Huck (2011) and Grubb (2015a) provide excellent overviews of different biases and resulting implications for competition. Expected gains from search can be temporarily or permanently affected by reference points (Kahneman and Tversky, 2013) or misperception of future demand, potentially due to time-inconsistent preferences (DellaVigna and Malmendier, 2004, 2006; Eliaz and Spiegler, 2011; Heidhues and Kőszegi, 2008), or overconfidence (Sandroni and Squintani, 2007; Grubb, 2009; 2015b). Willingness and ability to search may also be dampened by limited attention (Gabaix and Laibson, 2006). In addition, consumers may misperceive prices or quality or imperfectly recall prices collected during search (Chen et al., 2010), especially when they are composed of both up-front and recurring charges or multiple attributes, some of which may be more salient than others (Bordalo et al., 2013; Spiegler, 2016). And firms may recognize these challenges and adopt pricing frames that make comparisons particularly difficult (Bordalo et al., 2016; Kalaycı and Potters, 2011; Piccione and Spiegler, 2012). We return to supply-side responses in Section 4 below.

While the cited behavioral research is not specific to low-income households, Stango and Zinman, 2020 have recently added a survey to the RAND American Life Panel that elicits 17 different sources of behavioral consumer bias. These include limited attention, present bias, and underestimates of future value.[5] Although there is much within-group variation, the distribution of behavioral bias count, replicated in Figure 2, is shifted upwards for lower income households, implying that

[2] We note that there may also be rational reasons for lower levels of observed search that do not lead to similar equity concerns: low-income consumers may disproportionately anticipate purchasing fewer products or cheaper products or possibly making no purchase at all due to budget constraints, which would decrease the expected returns to search. Several of the papers described below attempt to isolate this confound by studying industries like electricity where product quality is homogeneous and no one opts out of the market. (Byrne et al., 2020) goes a step further using the audit-study approach to also fix quantity consumed.

[3] PEW: "92% of adults from households earning $75,000 or more a year say they have broadband internet at home, but that share falls to 56% among those whose annual household income falls below $30,000. That 36-point gap in broadband adoption between the highest- and lowest-income groups is substantially larger than the 24-point gap in smartphone ownership between these groups."

[4] Future research on identifying search-cost reducing impacts of online platforms both overall and across different income groups will need to acknowledge that the overall (equilibrium) effect of platforms on price levels and dispersion continues to be debated, and is potentially context-specific. Brynjolfsson and Smith, 2000, Scott Morton et al. (2001), Ater and Rigbi (2021) and Montag and Winter (2021) find that online search leads to lower overall prices, but Clay et al. (2001), Goolsbee (2001) and Clemons et al. (2002) find no effect. A tacitly collusive channel can instead lead to higher prices with the introduction of search platforms (Byrne and de Roos, 2019; Luco, 2019). With regard to price dispersion, Brown and Goolsbee (2002) find a non-monotonic impact of Internet usage on price dispersion that depends on the initial level of online search in a market. Chandra and Tappata (2011) formalize this non-monotonicity theoretically and further explore it using retail gasoline price data. Further, Ellison and Wolitzky (2012) find that online price comparisons reduce the cost of search across stores but firms respond by increasing the cost of in-store search by increasing the complexity of prices.

[5] Full set of biases measured: present bias in money discounting, present bias in consumption discounting, violations of General Axiom of Revealed Preference, violations of GARP and dominance avoidance, narrow bracketing, preference for certainty, loss aversion, ambiguity aversion, overconfidence

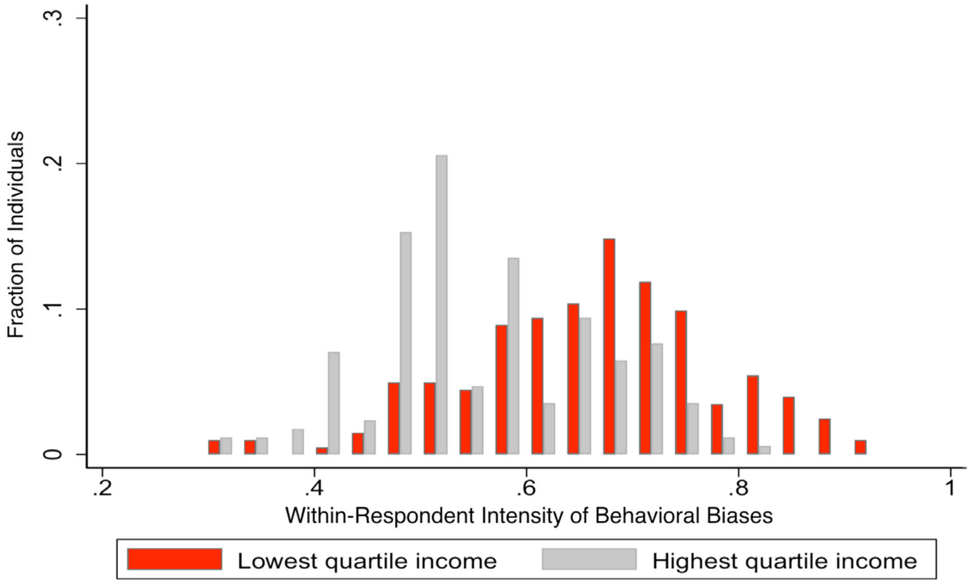

Fig. 2. Distribution of the intensity of behavioural consumer biases, by respondent income, from Stango and Zinman, 2020, color added. Notes: Displayed is a frequency histogram of the count of 17 potential biases observed in each individual, expressed as a fraction of non-missing, by respondent income quartile. The measures were obtained and calculated by Stango and Zinman, 2020 using a special survey added to RAND's American Life Panel. For example, if a respondent answered enough questions to calculate a measure of bias for 16 of the 17 indicators and their responses led to a classification of bias for 4 of the 16 measures, they would contribute a bias intensity of 0.25 to the overall distribution.

lower-income households suffer disproportionately from behavioral biases. Although this result is not the focus of their working paper, we believe it is an important result in its own right.

What do these behavioral biases say about ability to switch to the "right" plan, conditional on search? Data on plan-based services, combined with ex-post analyses of which offer would have been better, provides noisy results. Waddams Price and Wilson (2010) find that UK retail electricity deregulation led to disappointing outcomes: only 8-20% of consumers switched to the firm offering the highest surplus, and 17-32% of switching consumers picked a plan that made them worse off financially. They find little evidence, however, that reported household income drives ability to switch to the best plan. Similarly, Economides et al. (2008) and Miravete (2013) find few demographic variables are useful predictors of consumers' ability to make optimal decisions for telephone plans.

On the other hand, there is evidence that the poor are particularly bad when it comes to avoiding fees and fraudulent charges. Scholnick et al. (2008) finds that lower wealth and income individuals are more likely to be delinquent on credit card repayments despite having sufficient deposits available. And Letzler et al. (2017) show that consumers from low socio-economic status neighborhoods and racial and ethnic minorities are less likely to respond to FTC notification letters warning consumers that they were signed up to costly subscriptions by a fraudulent telemarketing company.

There are two interrelated factors that can drive these behaviors: the ability to pay attention and to make accurate price comparisons. Behavioral economists are increasingly finding causal linkages between household poverty, attention, and cognitive function. Although low-income individuals have been shown to be more aware of certain prices (Mullainathan and Shafir, 2013) and pay more attention to at-the-register taxes (Goldin and Homonoff, 2013), experimental evidence suggests that accumulated demands on attention over time lead to a reduction in bandwidth that reduces cognitive capacity to solve problems, retain information, and engage in logical reasoning (Mani et al., 2013; Mullainathan and Shafir, 2013; Haushofer and Fehr, 2014; Schilbach et al., 2016; Dean et al., 2018).

This line of research also shows that the intense focus on immediate concerns induced by resource scarcity impairs low-income households' ability to control impulses and engage in longer horizon planning. These effects have been shown to be broadly relevant: they have been documented not only in cases of extreme poverty, where malnutrition and sleep deprivation lead to direct physical effects (Bessone et al., 2020; Schofield), and stress, anxiety, and depression have been shown to limit cognitive function (Haushofer and Shapiro, 2016), but also among populations that are not traditionally poor, where resource scarcity is triggered in an experimental setting (Mullainathan and Shafir, 2013). These causal effects of poverty on cognitive processing and failures to consider all available options speaks directly to the ability of consumers to

in level performance, overconfidence in precision, overconfidence in relative performance, underestimates convergence: non-belief in the law of large numbers, Cold Hand Gambler's Fallacy, underestimates APR: exponential growth bias, loan-side, underestimates future value: exponential growth bias, asset-side, limited attention, and limited memory.

notice and recall price alternatives and undertake costly calculations required to search among sellers. Ultimately, this limits a low-income consumer's expected gains from undertaking costly search.

Parallel research in financial literacy similarly finds that the ability to recall and process price comparisons accurately increases with individual income. Lusardi and Tufano (2015) show that financial literacy with respect to debt increases dramatically with household income levels. Calvet et al. (2009) find that the tendency to make financial 'mistakes' decreases strictly with wealth. And Hastings et al. (2017), who observe fees for retirement accounts across the income distribution in Mexico, find less-educated workers are less financially literate, less likely to know facts about their accounts and the savings and retirement system in general, and are most influenced by sales force concentration.

3.4. Negotiating effectively

There is sometimes the perception that low-income consumers are particularly comfortable haggling, based perhaps on the prevalence of markets with unposted prices and haggling in developing countries. However, empirical evidence dating back at least to (List, 2004) points to low-income and African-American and Hispanic minorities losing out in price negotiations. This area of research is particularly important for discrimination in search markets because deregulation can organically lead to individually-negotiated prices in markets with consumer search frictions, as has occurred in retail electricity markets (Byrne et al., 2020), mortgages (Allen et al., 2019), and health insurance (Barber et al., 2019).

Scott Morton et al. (2003) is a notable study on negotiation and socioeconomic disadvantage. Using negotiated price data from new car sales, they find that disadvantaged minorities pay 2.0 to 2.3% more for their cars than white consumers, representing an almost 30% higher markup, when visiting offline retailers. The relationship that they document is U-shaped: for a given car, price paid decreases with the buyer's income until the average census block income reaches $80,000, at which point increases in income increase price. The authors also document that the differential markup disappears when shopping online, which suggests a particular income-related disadvantage when it comes to willingness or ability to negotiate.

There is still much to learn about the mechanisms that may drive the observed disadvantage in negotiation. English language ability may be an issue for some low-income groups. Research from Organizational Behavior argues that individuals who are successful in negotiation, or persuasion more broadly, need to establish credibility, common ground, and emotional connection (Conger, 1998), which may be harder for consumers of outsider or lower social status. Furthermore, feeling or looking anxious results in suboptimal negotiation outcomes (Brooks and Schweitzer, 2011) and Section 3.3 above documented an extensive literature connecting lower incomes with increased anxiety. Finally, some of the challenges of self-confidence or assertiveness (being self-assured and confident without being aggressive) that have been documented in the gender gaps in negotiation (e.g., Bowles, 2013; Hernandez-Arenaz and Iriberri, 2019) may apply to lower income individuals as well. Future research that examines whether and the extent to which these and other negotiation-related costs vary with income, which can, for example, translate to smaller bargaining weights in a Nash Bargaining model, can shed light on sources of income inequality in search markets with individually-negotiated prices.[6]

4. Supply-side responses to search costs

We have thus far documented evidence of a search-income gradient and identified potential mechanisms for why low-income households may be less likely to engage in search behavior. In this last section we provide evidence that, in some markets, oligopolists discriminate based on consumer search costs, which can give rise to regressive price dispersion in search markets. We also discuss the relevance to income inequality of the literature documenting that firms may attempt to directly influence consumer information sets and search costs through advertising or obfuscation.

4.1. Search-based price discrimination

Recent papers have begun to consider price discrimination based on search frictions.[7] Armstrong and Vickers (2019) study a Bertrand pricing game with asymmetric firms who have different shares of "captive" consumers (e.g., those who do not search for rival prices) and "non-captive" consumers (e.g., those who search), showing that captive consumers are discriminated against and pay higher (expected) prices in the model's asymmetric equilibrium. In related work, Fabra and Reguant (2020) study competitive third-degree price discrimination in a setting where consumers' gains from or costs to search is correlated with an observable characteristic (like buyer size), while realized search costs and search behavior go unobserved. They document counteracting "gains from search" versus "signaling" effects which determine whether individuals with higher expected search costs (and/or lower expected gains from search) pay higher prices in equilibrium.

[6] Researchers have recently started to estimate bargaining costs using structural models in which consumers decide whether to bargain or not (Jindal and Newberry, 2018). With appropriate data, these models could be adapted to identify the bargaining cost-income gradient.

[7] Canonical models of oligopoly pricing in search markets predict that consumers with higher search costs pay higher prices in equilibrium, and that search costs can explain equilibrium price dispersion (Burdett and Judd, 1983; Salop and Stiglitz, 1982; Stahl, 1989; Stigler, 1961), with a thorough overview by Baye et al. (2006). These models mainly focus on symmetric equilibria with price dispersion across firms and where each firm charges just one price at any given point in time; in contrast recent models allow for asymmetric equilibria (Armstrong and Vickers, 2019) or price discrimination (Fabra and Reguant, 2020).

They show that the underlying shape of the search cost distribution determines which force dominates and the form that price discrimination will take.[8]

Both Armstrong and Vickers (2019) and Fabra and Reguant (2020) emphasize that whether uniform pricing or price discrimination is preferred from a consumer welfare perspective depends crucially on the degree of asymmetry in shares of captive consumers across firms and the shape of the distribution of search costs. This sensitivity highlights the need for empirical research on search-based price discrimination to reflect industry-specific differences in economic primitives like search cost distributions in order to evaluate both *total* and *distributional* welfare impacts of price discrimination.

Emerging empirical evidence points to the existence of such search-based price discrimination. Allen et al. (2019) find that banks make higher mortgage offers to borrowers looking for an initial price quote from their home bank if they have higher expected observable search costs from obtaining price offers from rival banks. And in the context of retail electricity, Byrne et al. (2020) use an audit study approach to show that firms' initial price offers in sequential bargaining games over electricity contracts depend on a consumers' ex-ante perceived cost of searching for an outside price offer.

Byrne et al. (2020) further show that providing low reference prices strongly helps consumers obtain lower negotiated prices, echoing previous findings from Scott Morton et al. (2003) and Busse et al. (2017) on the importance of being informed about market prices in negotiations. Regressive forms of price dispersion can arise if firms engage in private negotiations to price discriminate and low-income consumers are less likely to obtain rival price quotes before entering negotiations.

This research echoes recent work that documents that firms discriminate based on perceived behavioral biases. Gabaix and Laibson (2006) and Ru and Schoar, 2016 document discrimination based on inattention or misunderstanding of contract terms (shrouded attributes) with, in the case of Ru and Schoar, 2016, pro-active use of rewards programs to identify unsophisticated consumers. Grubb (2015b) describes how firms specially target plans at overconfident consumers. Heidhues and Kőszegi (2017) develop a behavioral theory of discrimination based on perceptions of present-bias, with an application to borrowers in credit markets (naïveté-based discrimination). The authors explicitly note potentially distributional consequences of such discrimination: "[...] naive consumers bear over 100% of the social welfare loss. In as much as consumers who make financial mistakes have lower incomes than average (Calvet et al., 2009), such a distributional impact is extremely adverse."

While the cited theory and empirics on search-based price discrimination largely focuses on traditional offline markets, there is a separate burgeoning area of research into privacy regulation and personalized pricing (e.g., an extreme form of third degree price discrimination) in digital markets, which could similarly have distributional implications. Bergemann and Bonatti (2019) provide an extensive overview of theoretical work in this area, while Goldfarb and Tucker (2020) more specifically review research on inequality and privacy in digital market design. The latter review yields a familiar message: an industry-based approach is necessary for studying welfare impacts of discrimination against vulnerable consumers in digital markets, and in designing and implementing privacy regulations. Indeed, there are examples where relatively disadvantaged online market participants benefit from discrimination. Miller and Tucker (2011) find providing private health information can lead to higher quality healthcare for disadvantaged groups. Likewise, Dubé and Misra (2020) finds smaller businesses can benefit from revealing private information to obtain personalized prices for talent recruitment on Ziprecruiter instead of being priced out of the market under uniform pricing on the platform.

4.2. Advertising and obfuscation

Sellers may also attempt to directly manipulate search costs by strategically reducing price transparency or increasing the complexity involved in product choice. While research on both advertising and obfuscation is well-established in IO (Fisher-Ellison, 2016), we have been unable to find research that breaks down marketing or obfuscation success by household income levels. As mentioned, Hastings et al. (2017) find lower-income households are more influenced by sales force advertising in the Mexican retirement savings industry. Bhargava and Manoli (2015) show that the poor are also more responsive to presentation. In particular, they find that more visually-appealing prompts and shorter worksheets disproportionately motivate low-income earners to claim Earned Income Tax Credits. But questions remain over which types of consumers are disproportionately responsive to teaser rates, emotional appeals, obfuscated fees, framing and irrelevant information. We see this as an important area for research in IO which sits at the intersection of competition policy and consumer protection.

5. Conclusion

This paper was motivated by the case of competition in retail electricity, where the IO literature preceding deregulation in many countries focused on the net gains from competition: whether increased expenditures on retailer advertising would be offset by efficiency gains in cost savings and expansion of product offerings (Joskow, 2000; Littlechild, 2009). In practice, the evidence on the net level of prices has been mixed, while policy discourse has been overwhelmed with discussions of

[8] For example, they show that equilibrium expected prices conditional on search can decrease with buyer size if search costs are exponentially distributed, increase or be flat if uniformly distributed, and have an inverse-U relationship if normally distributed.

regressive price dispersion and poorer consumers being disengaged from the market (Flores and Price, 2018; Nelson et al., 2018; Simshauser and Whish-Wilson, 2017; Waddams Price and Zhu, 2016). Across the many jurisdictions that deregulated, the resulting markets have been characterized by complex offers, customer inattention and confusion, low levels of retailer search and switching, and lower income and vulnerable consumers paying higher prices.

Regulators anticipated that when moving from regulated prices to market competition, consumers would self-sort into different prices based on *willingness* to search, with higher incomes paying more because they could not be bothered to shop around. In practice, however, consumers appear to also have sorted based on *ability* to search, which as this article has shown tends to disproportionately constrain lower-income households. Given emerging evidence that firms discriminate based on search costs, the distribution of prices paid may be progressive if willingness to search drives the search-income gradient. However, if search is primarily driven by ability, the resulting distribution of prices can end up being regressive. The experience of retail electricity markets that have undergone deregulation points towards the net effect being regressive in that sector.

Our literature review suggests that the experience in electricity deregulation may speak to other industries as well, which we think highlights key areas for future research. Indeed, we believe IO researchers can play an important role in understanding how firms' exercise of market power in products and services markets contributes to income inequality, particularly when consumers face heterogeneous search costs.[9] Underpinning this belief is the research we have summarized: (i) how search varies over the income distribution; (ii) potential channels for why low-income households disproportionately fail to engage in search; and (iii) theory and empirics of search-based price discrimination. Given that many large and important industries feature search frictions and household income heterogeneity, there are many fruitful areas for future research in examining how market power contributes to inequality and households' overall cost of living.

Many questions for IO economists come to mind. Can a merger increase prices disproportionately for lower income consumers, and if so, when? Likewise, do price controls disproportionately affect different income groups? Do regulations that limit aggressive advertising or hidden fees affect welfare more for lower income consumers?

The study of inequality has been the cornerstone of many fields for years, and is now coming to fields where that has not traditionally been the focus, ranging from macroeconomics (e.g., Kaplan et al., 2018; Chetty, Friedman, Hendren, Stepner) to market design (e.g., Dworczak et al., 2020).[10] We believe that IO researchers can likewise expand our understanding of the drivers of economic inequality and its many consequences. In particular, IO's contribution of identifying demand-side frictions and how firms account for them in their pricing decisions, in the context of individual industries, incorporating their institutional detail, has much to offer in informing pressing questions of how market power exacerbates differences in prices paid among rich and poor households, and in informing efficiency-equity trade-offs in policy design.

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[9] In this way, the line of research that we propose in this paper complements current research on how firms' exercise of market power in labor markets affects lower-paying jobs at "superstar" firms and workers in the gig economy (Autor et al., 2020; Dubé, Misra).

[10] By exploiting new microdata, macroeconomists are examining how the distribution of income influences that overall level of economic performance with related implications for monetary and fiscal policy (e.g., Kaplan et al., 2018; Chetty, Friedman, Hendren, Stepner). Researchers in market design are considering the role of markets and how design considerations can trade-off allocative efficiency for increased equity (e.g., Dworczak et al., 2020). This emerging area of research is motivated by the simple observation of many distortionary but redistributive policies are, in practice, at the center of market design.

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